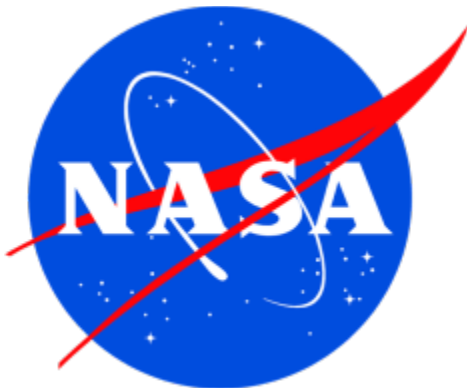


Potential examples of utilizing the Virtual Reality System for assessing spatial orientation awareness during sensorimotor adaptation to gravity transitions

Scott Wood

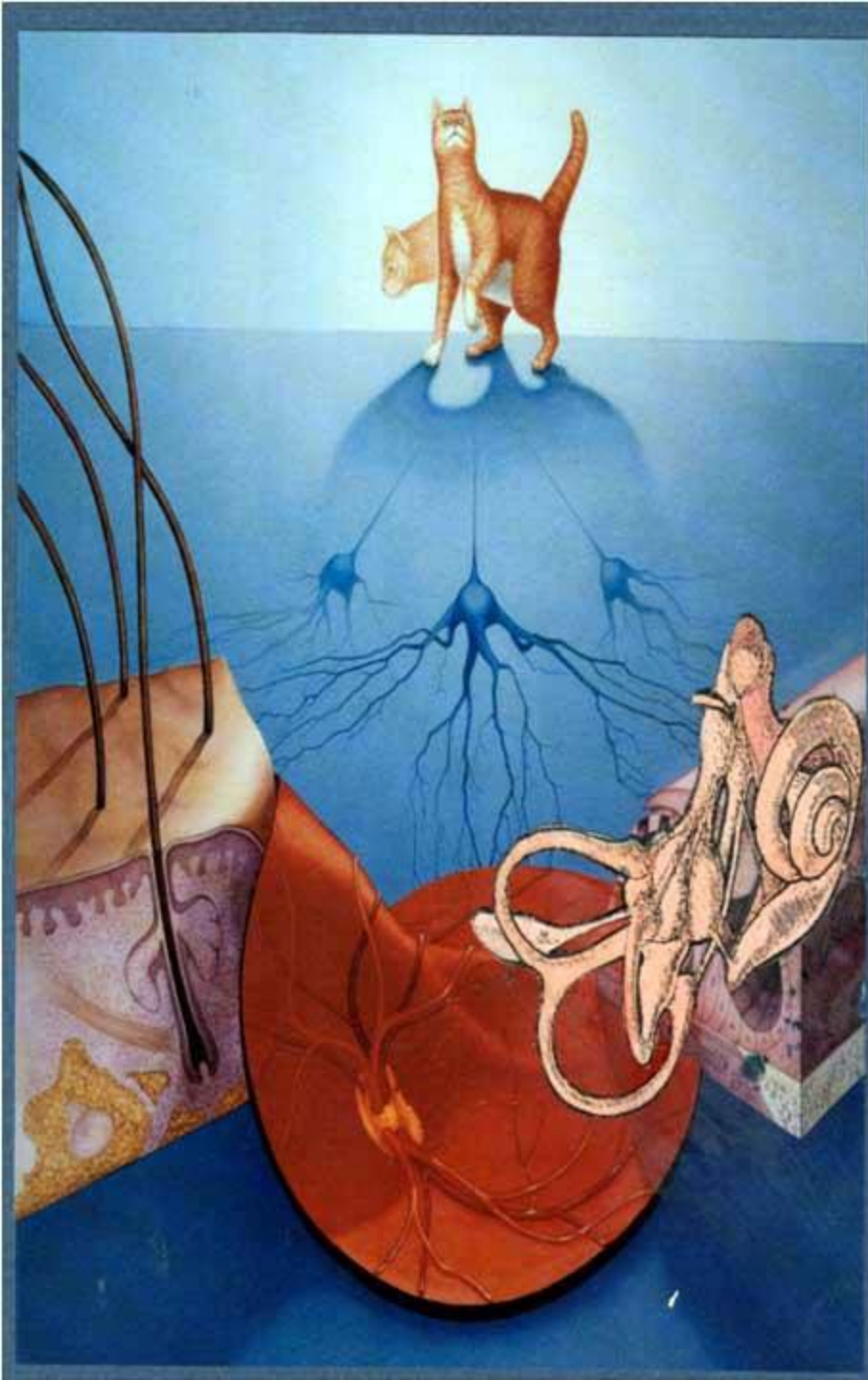
Universities Space Research Association
Human Adaptation & Countermeasures Division
NASA Johnson Space Center
Houston, TX

Enhanced Virtual Reality Stimulator (eVRS) Workshop
January 2012, Brussels



Potential applications for eVRS

1. Spatial cognitive function
 - Ground-based analog -> flight study
 - Parabolic study - integration with vibrotactile feedback
2. Visually-evoked autonomic responses
 - Ground-based VR study
3. Operational simulations
 - Pre / post ISS manual control study
 - Future ISS telerobotics?

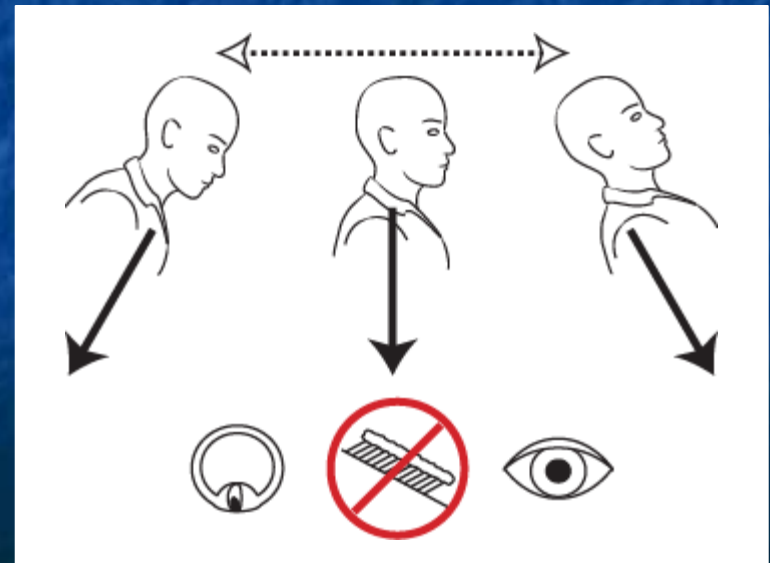


Scientific objectives

How does the central nervous system resolve new patterns of sensory cues during G-transitions in order to derive accurate spatial orientation awareness?

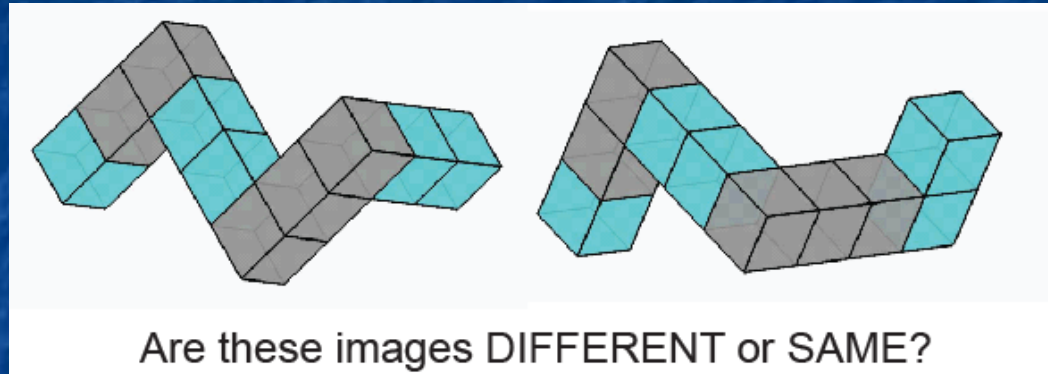
Can sensory supplementation (e.g., vibrotactile cueing of spatial vertical) improve spatial orientation?

Ground analog: Tilt-Translation Sled

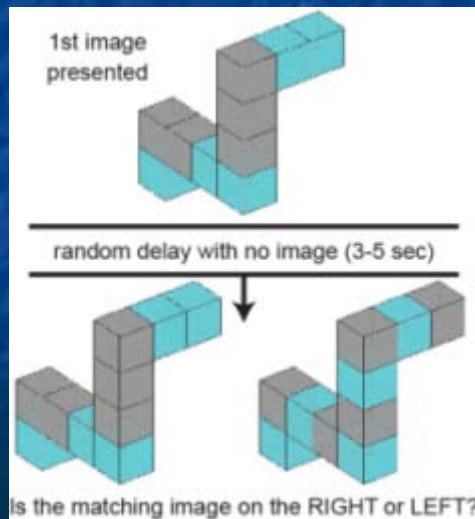


Spatial cognitive measures

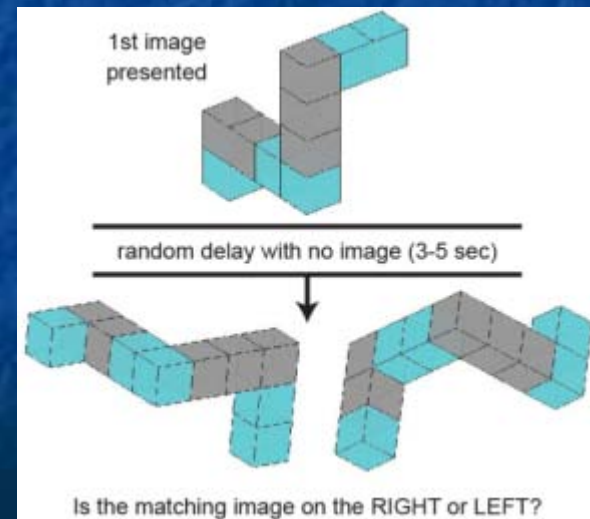
Mental rotation



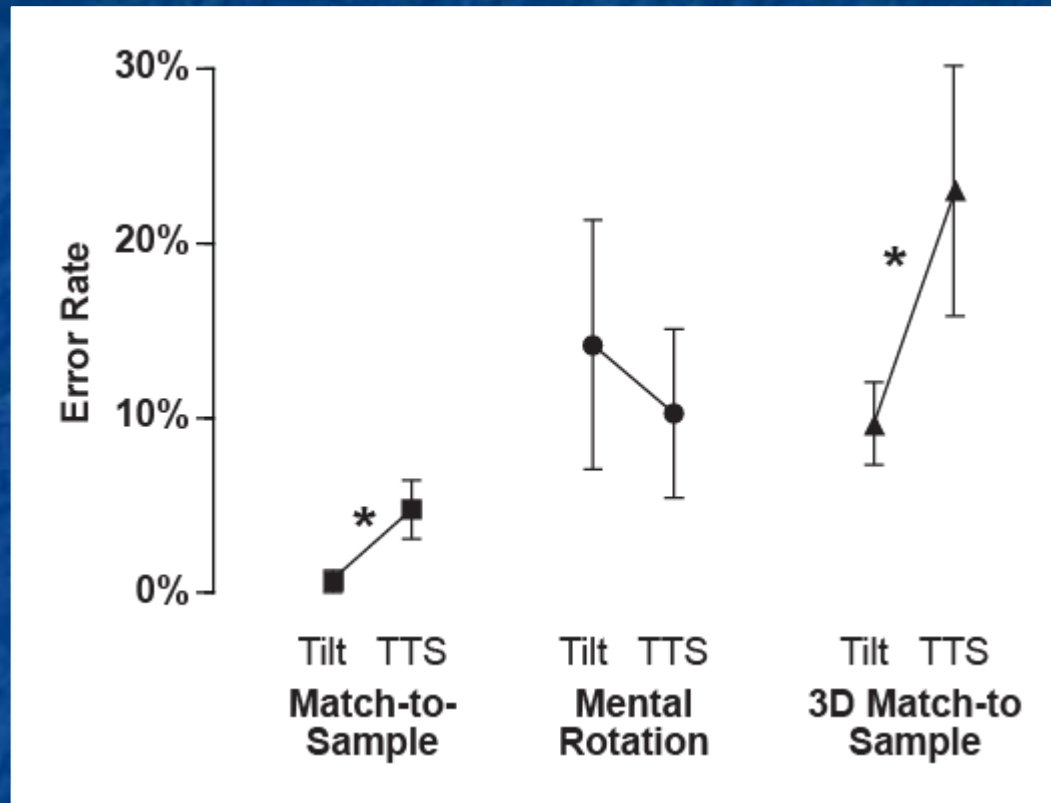
Match-to-sample



3D Match-to-sample

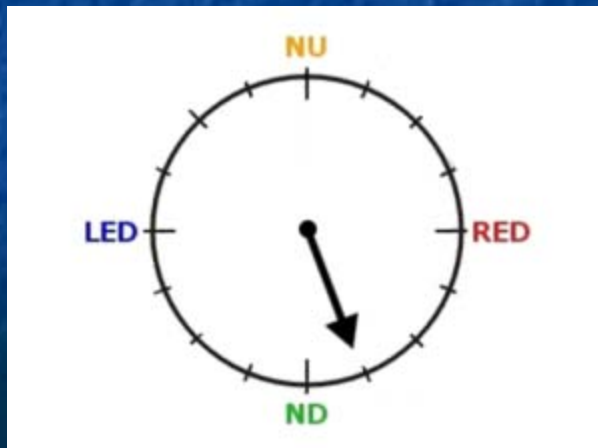
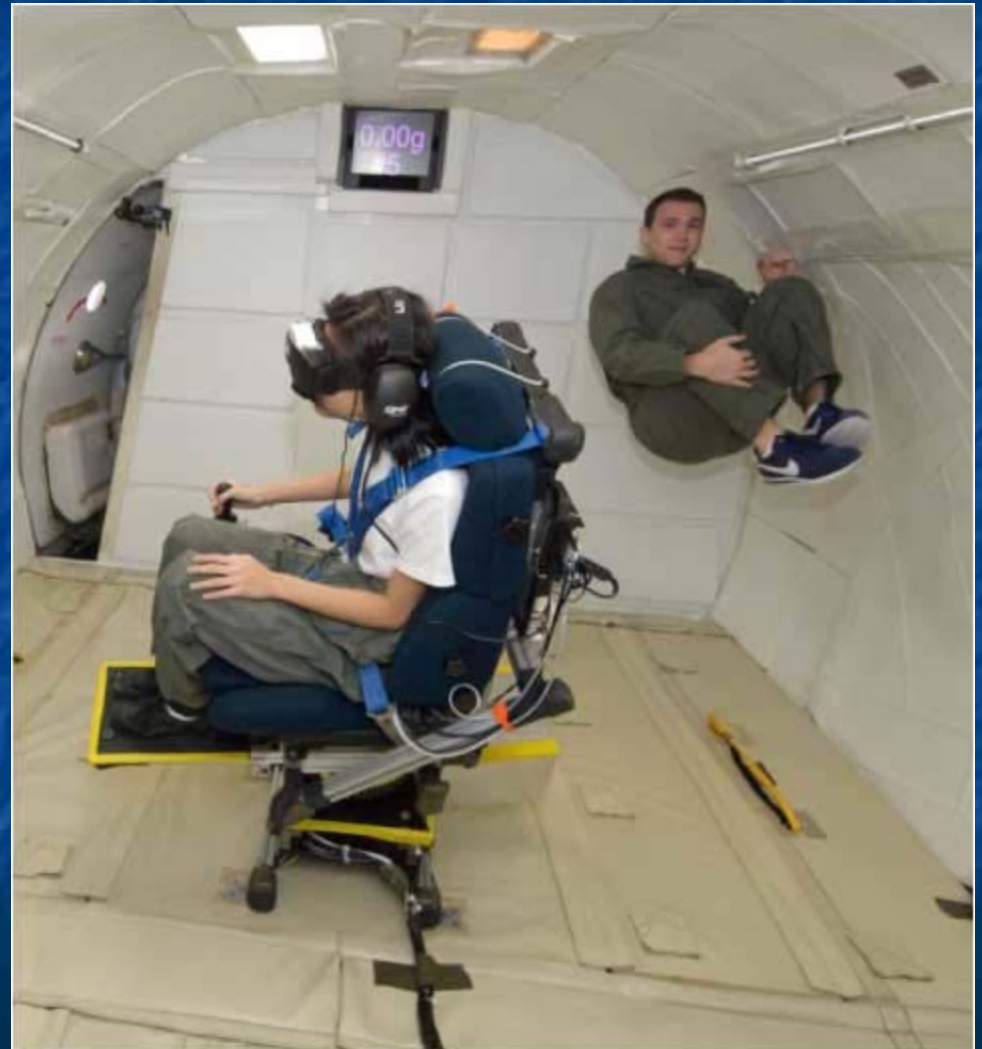


Spatial memory is impaired during conflicting tilt-translation sensory cues

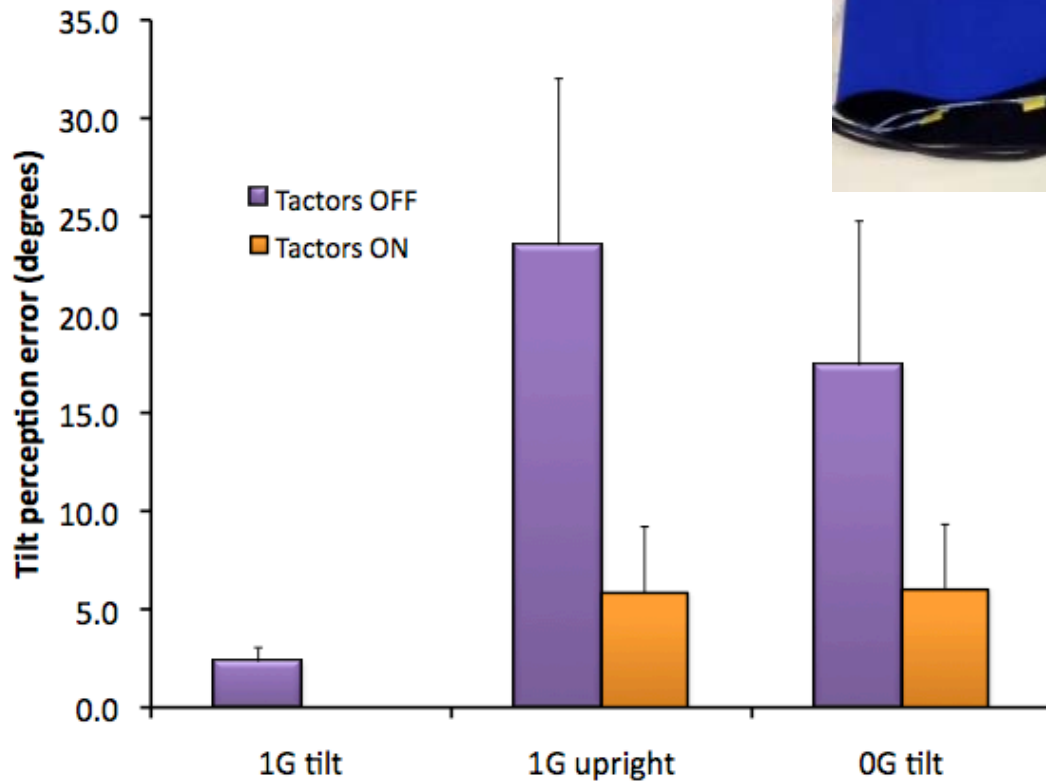


New ISS study: Spaceflight effects on neurocognitive performance: extent, longevity, and neural bases (R Seidler)

Off-vertical rotation during parabolic flight



Tactile cueing of spatial vertical

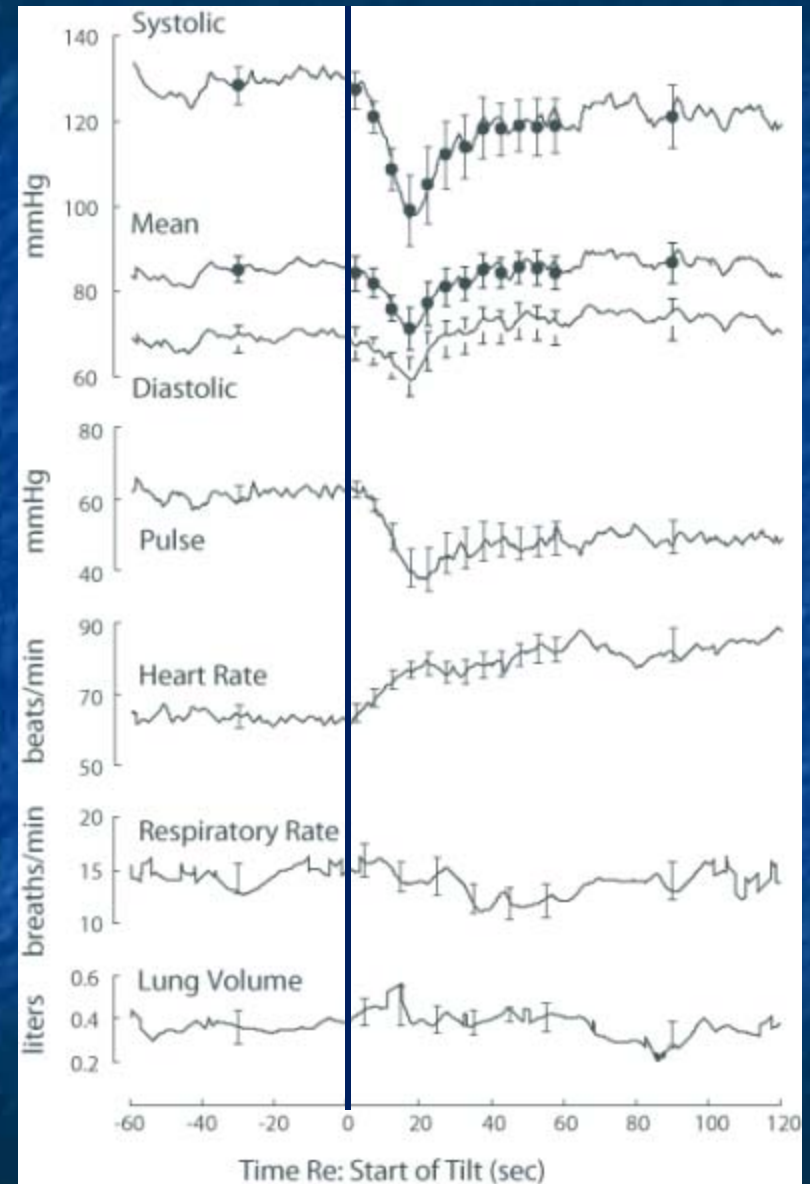


New ISS study: Straight ahead in microgravity (G Clément)

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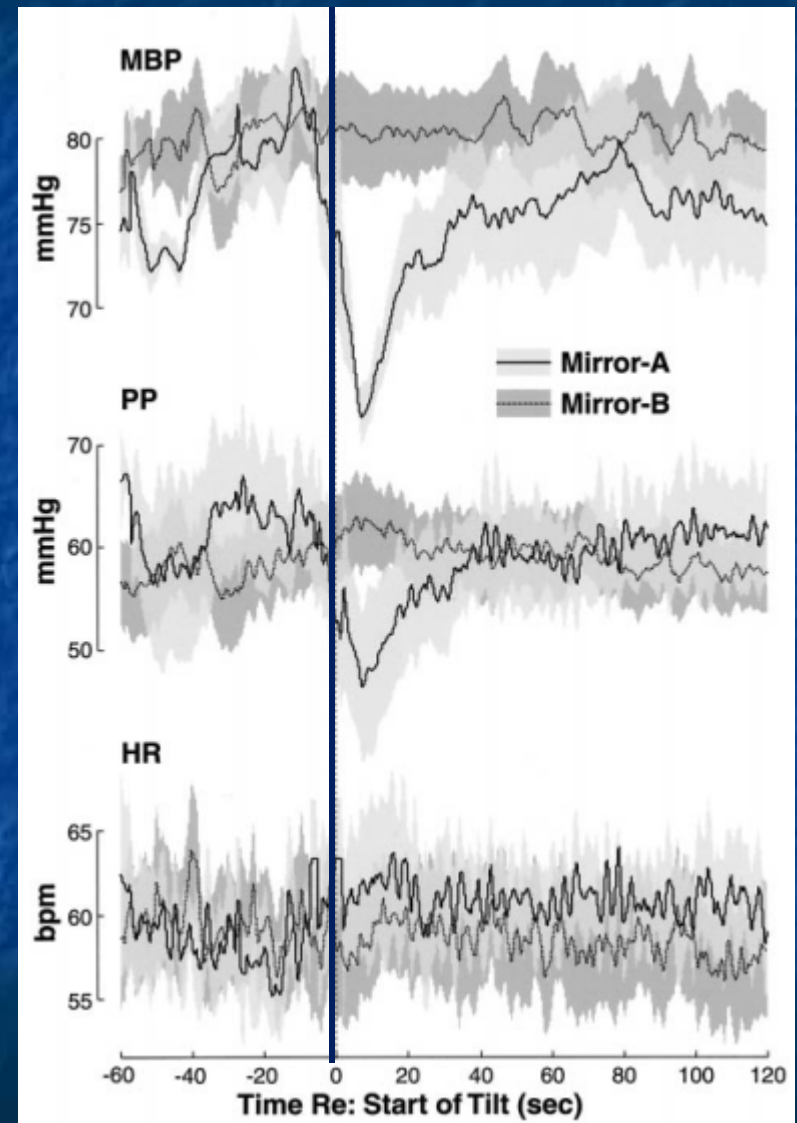
Cardio-respiratory responses to HUT



Visually evoked autonomic responses



Wood et al, Brain Res Bull, 2000



Potential applications for eVRS

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Rover Simulation

Motion base

- Stewart-type
- 6DOF up to 20° tilt

Simulator cabin

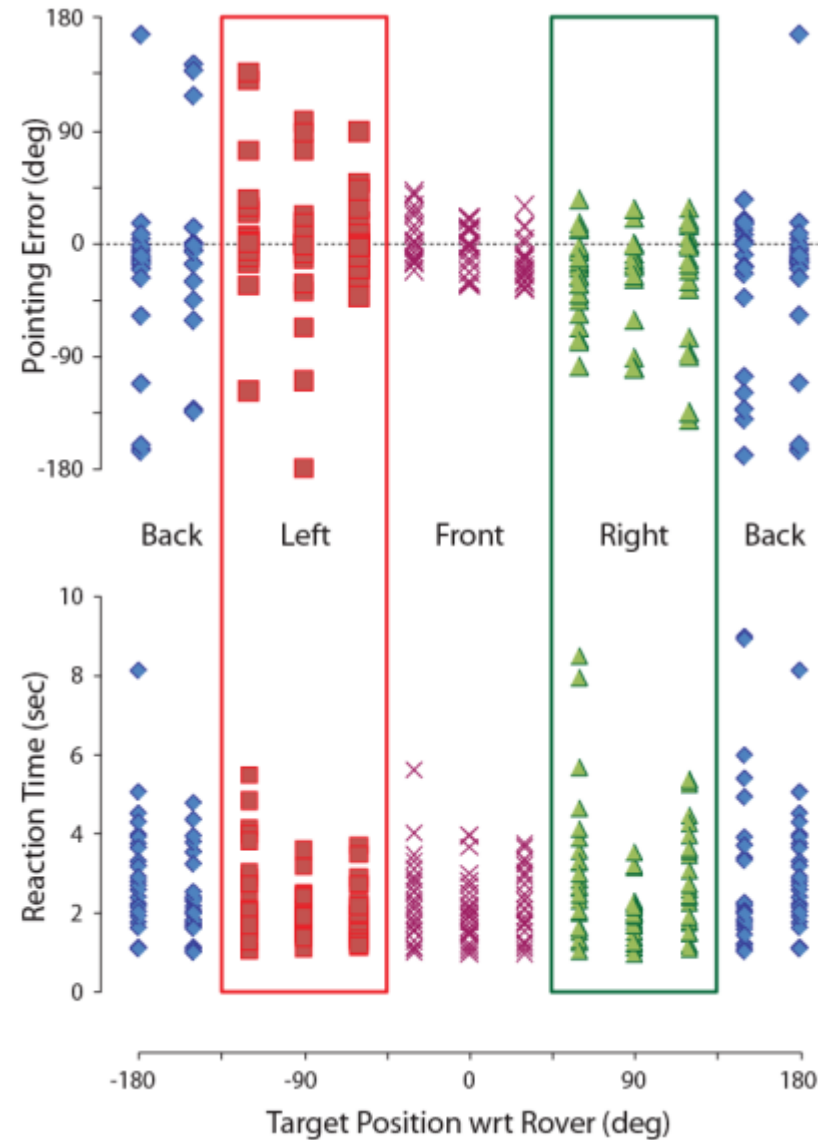
- Single seat cabin
- Triple scene projection
 150° Hor x 50° Ver
- Joystick controller

Simulator software

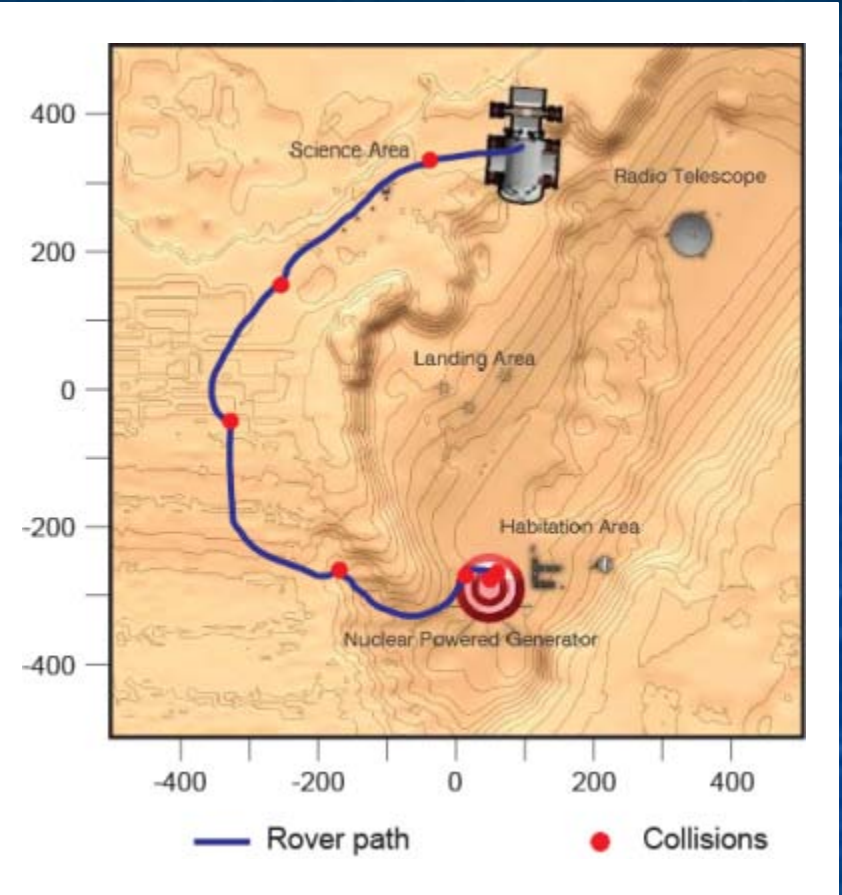
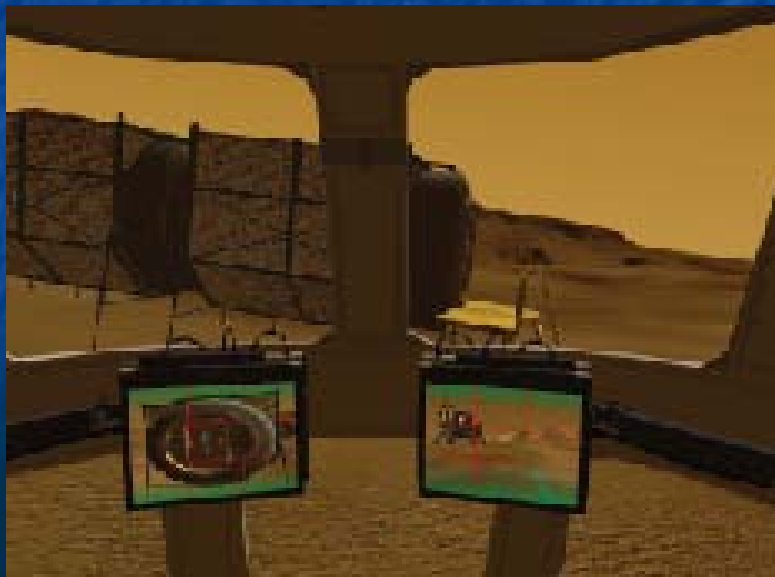
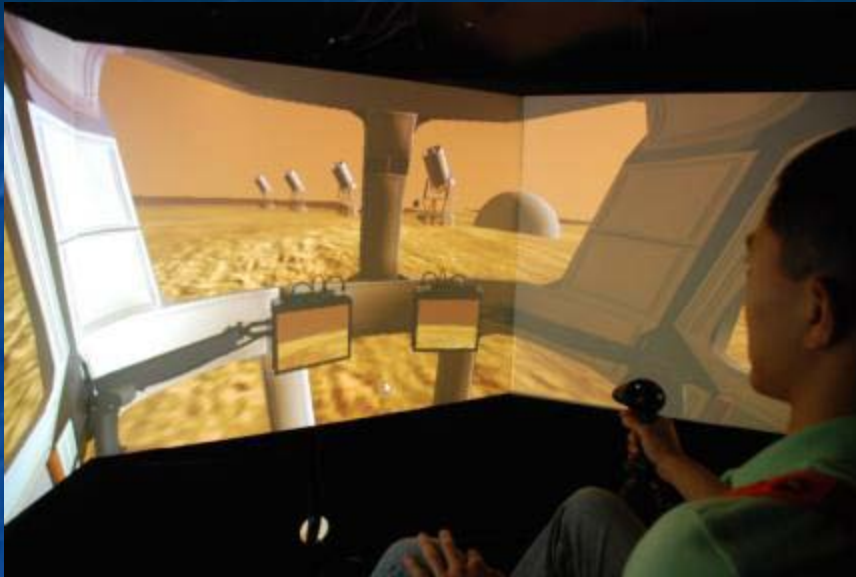
- Unity3 - next-gen PhysX
- Admin C# applications



Perspective Taking



Navigation and Docking



Implement on ISS
for telerobotics sim?